



2006 Massachusetts Smart Growth Conference

Worcester, MA

Wastewater Alternatives for Unsewered Waters

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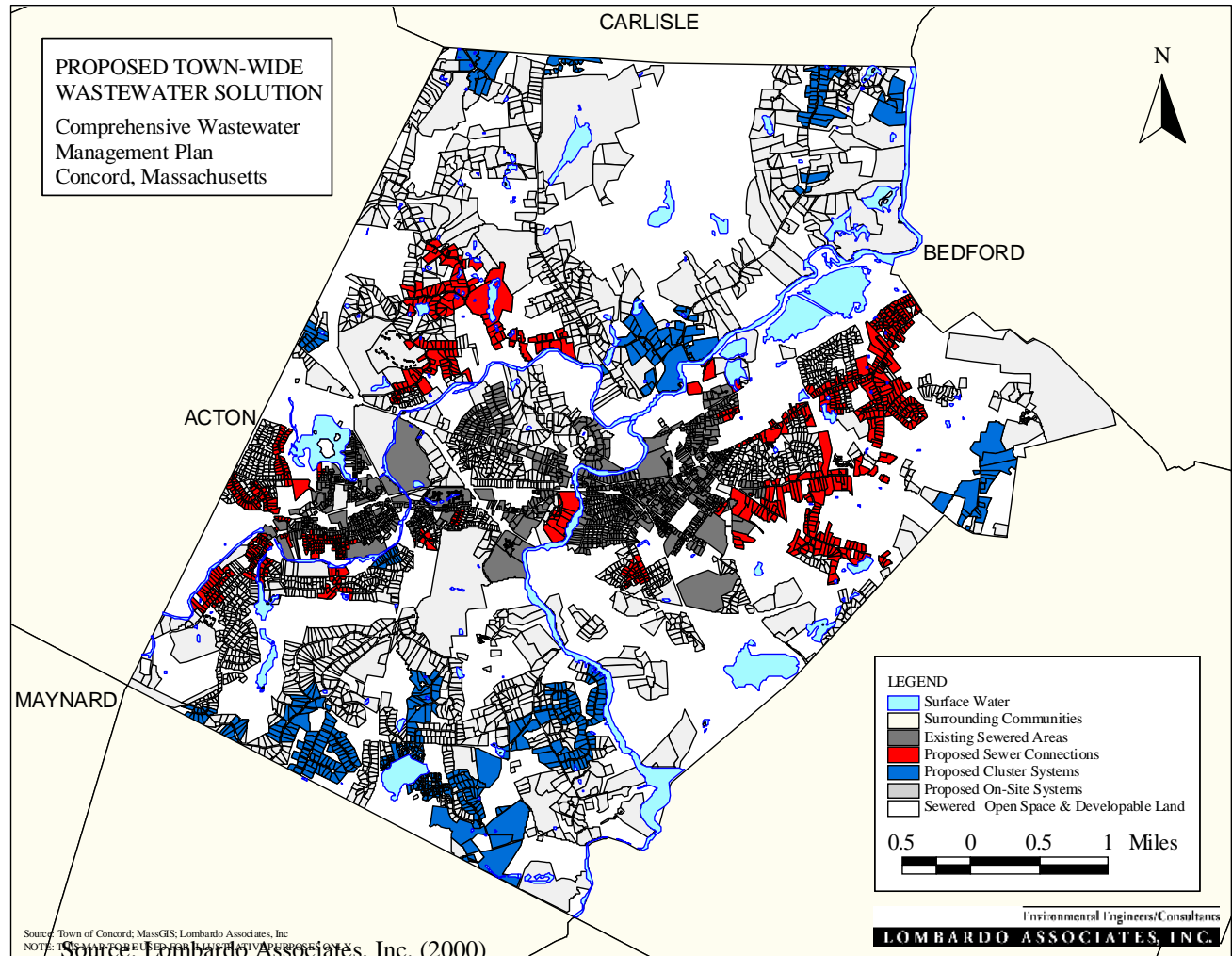


Visions of Community-Wide Decentralized / Distributed System

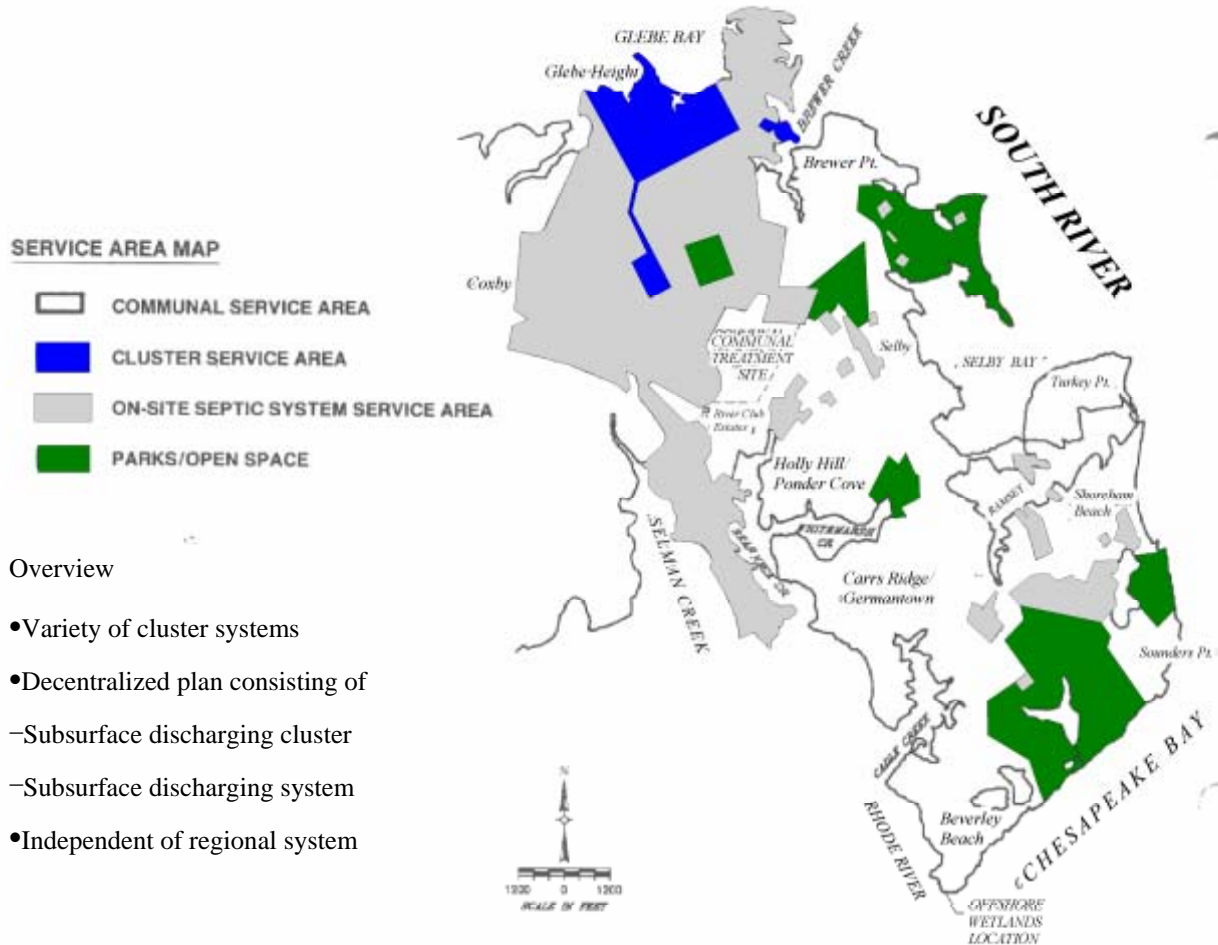
- Community Wide
- Neighborhood Areas

Concord, Massachusetts

	Maximum Alternative
Included Parcels Requiring Off-Site Solutions	387
Included Parcels With Other Wastewater Needs	266
Included Parcels With No Identified Wastewater Needs	726
Build-Out Potential	166
Total Parcels Included in Off-Site Solutions	1,495
Parcels Requiring Off-Site Solutions Within Existing Sewer Area	35
Parcels Requiring Off-Site Solutions to be Addressed by Variances	15
Non-Problem Systems	2,304
Total Existing Developed, Unsewered Parcels	3,849



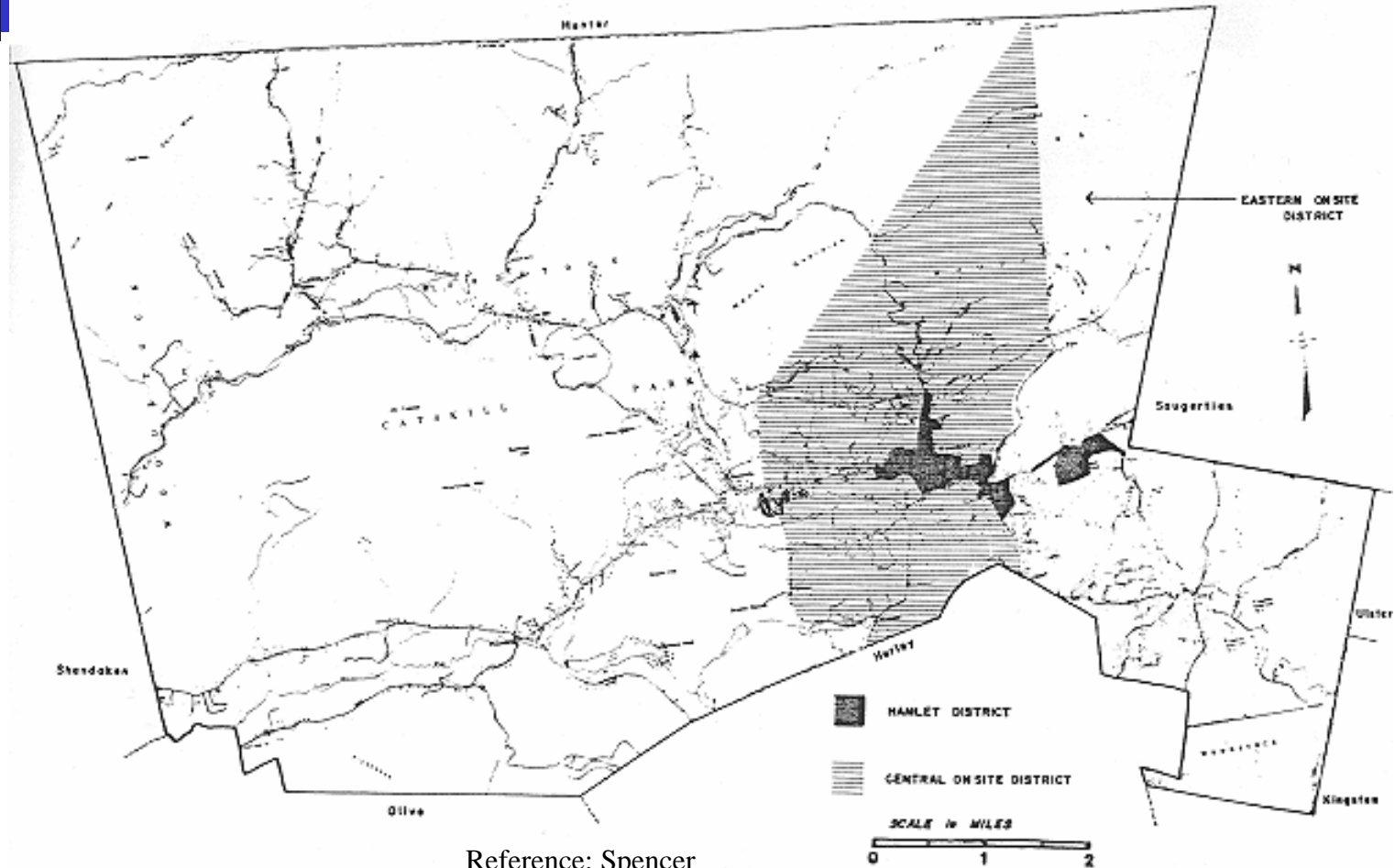
Mayo Peninsula, Maryland



Overview

- Variety of cluster systems
- Decentralized plan consisting of
 - Subsurface discharging cluster
 - Subsurface discharging system
- Independent of regional system

Woodstock, New York



Reference: Spencer
(1983)

Overview

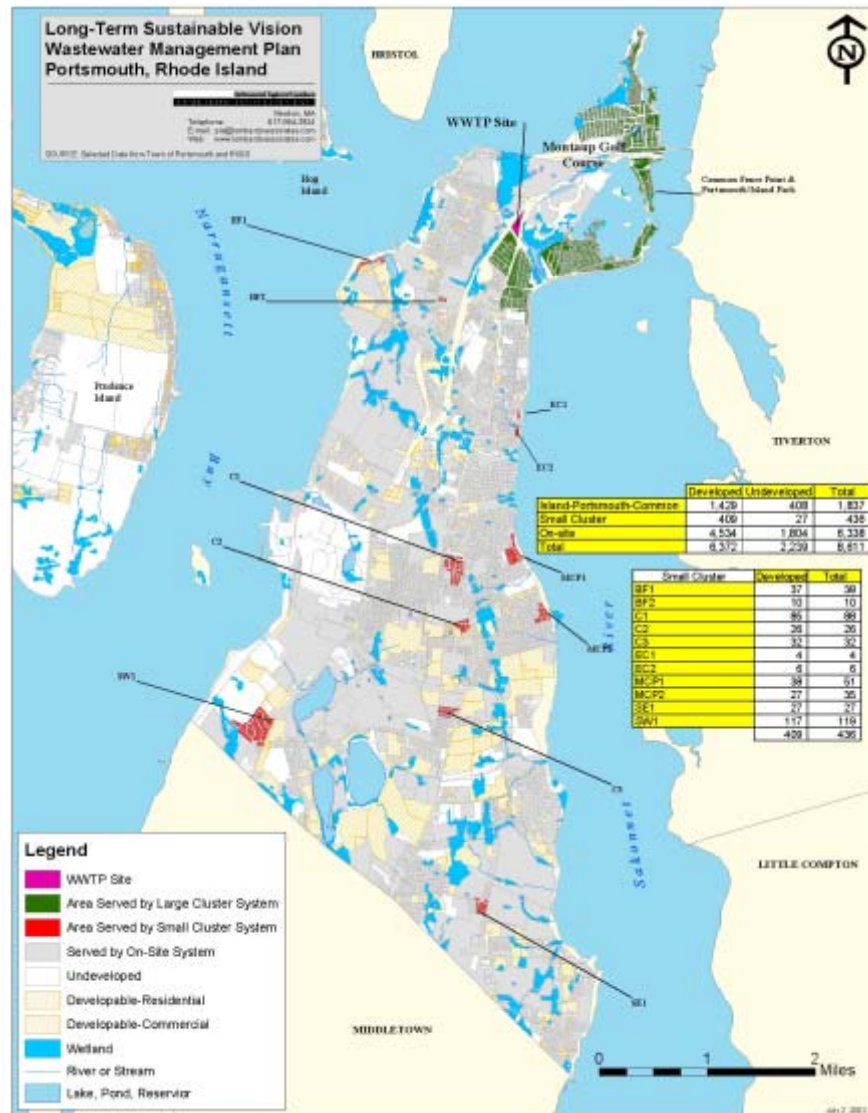
- A Type II surface discharging cluster system serving 432 properties in the commercial hamlet area
- Seven small Type I cluster systems in the onsite wastewater districts. Each cluster generally served two to three properties.

Portsmouth, Rhode Island

Overview

- Twelve Type I cluster systems
- Large Type II system with a golf course subsurface dispersal system
- Lower cost salvaging enabled for 4,534 onsite systems

Source: Lombardo Associates, Inc.
(2003)





Mashpee, MA

- 24 units mixed housing (40 B)
- 9,800 SF Commercial
- Flow 5,226 gpd



Hamilton Business District

- 20,4000 gpd
- 26 users – 62 EDUs



Lake Wyola, Shutesbury, MA

- 200 Users – Residential
- 50,000 gpd



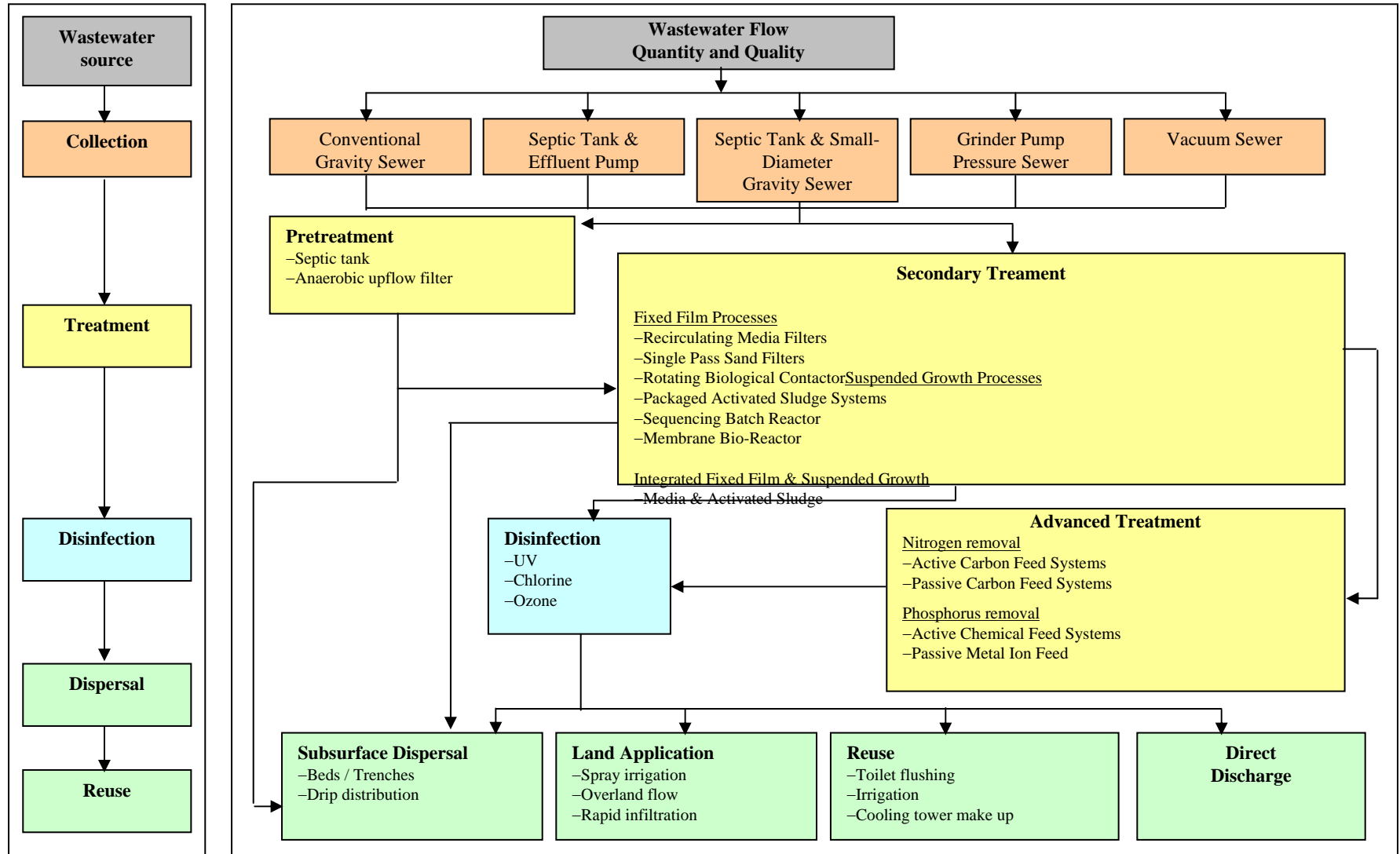
Cluster – Decentralized Wastewater Systems – Permitting – Size Options

- Title 5 Systems < 10,000 gpd
- Groundwater Discharge Permits > 10,000 gpd

10,000 gpd ~ 250 homes

- No Net Nitrogen Contribution may be required in nitrogen impaired watersheds

Collection, Treatment, and Dispersal Technologies Suitable for Cluster Wastewater Systems





Collection Systems

- Collection Systems
 - Conventional Gravity
 - Septic Tank Effluent – gravity (STEG) and/or pressure (STEP)
 - Grinder Pumps - Pressure



Treatment Systems

- There are four basic configurations:
 - Single Pass Filters (SPF)
 - Recirculating Media Filters (RMF)
 - Integrated Fixed Film - Activated Sludge (IFAS)
 - Activated Sludge (AS)



Single Pass & Recirculating Media Filters (RMF)

- Most applicable to the smaller flows and corresponding high variation in loading that occurs in small, residential and commercial developments.
- Footprint of systems becomes large as flow increases
- For flows at or $< 50,000$ gpd, RMFs provide more reliable process with lower life-cycle costs than other technologies
- For flows $> 100,000$ gpd, the economies of scale favor other technologies
- For flows $50,000 - 100,000$ gpd, there should be case by case evaluation



Suspended Growth Process

- The generic options for suspended growth technologies are:
 - Packaged Conventional and Modified Activated Sludge Processes
 - Sequencing Batch Reactors (SBR)
 - Membrane Bioreactors (MBR)
- The major drawbacks of suspended growth systems are:
 - Higher sludge production and associated disposal issues
 - High energy consumption
 - High degree of operator involvement/skill required
 - More sensitive to varying loading rates and process upsets



Integrated Fixed Film and Suspended Growth Processes

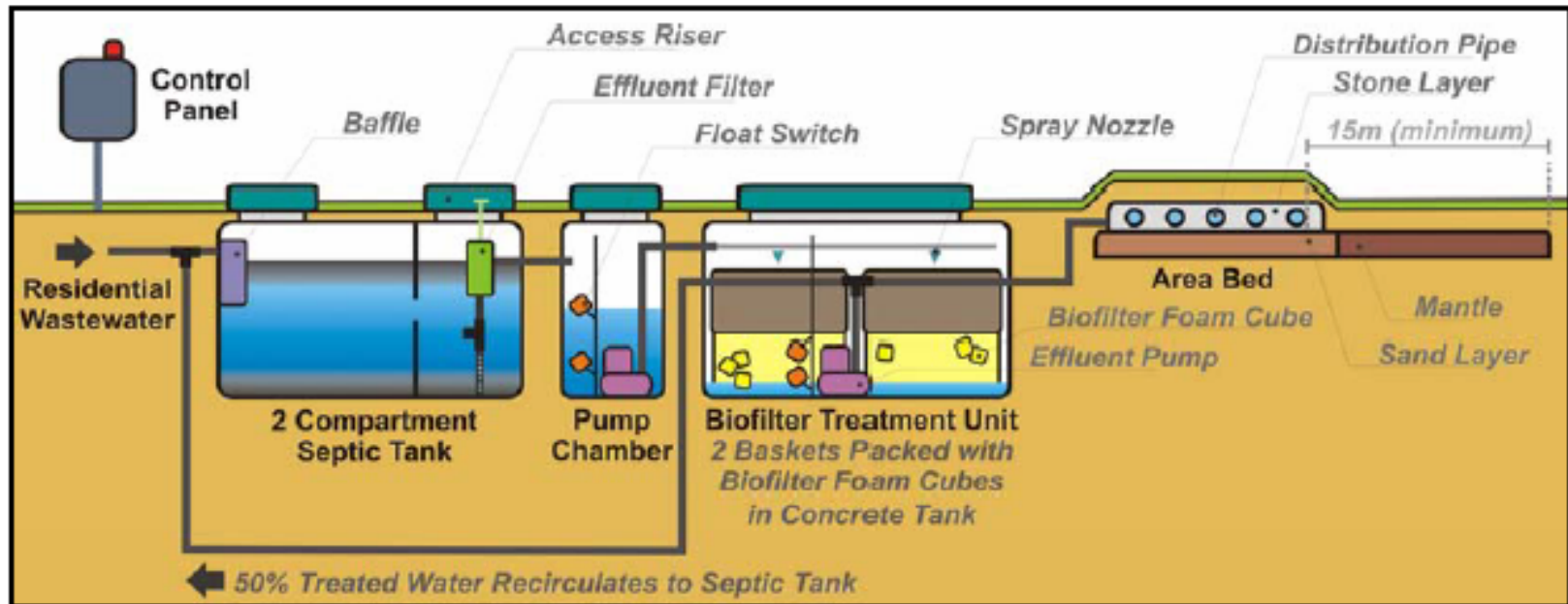
- Combine the fixed film and suspended growth technologies in one treatment process
- Examples:
 - FAST
 - AccuWeb
 - LOTUS



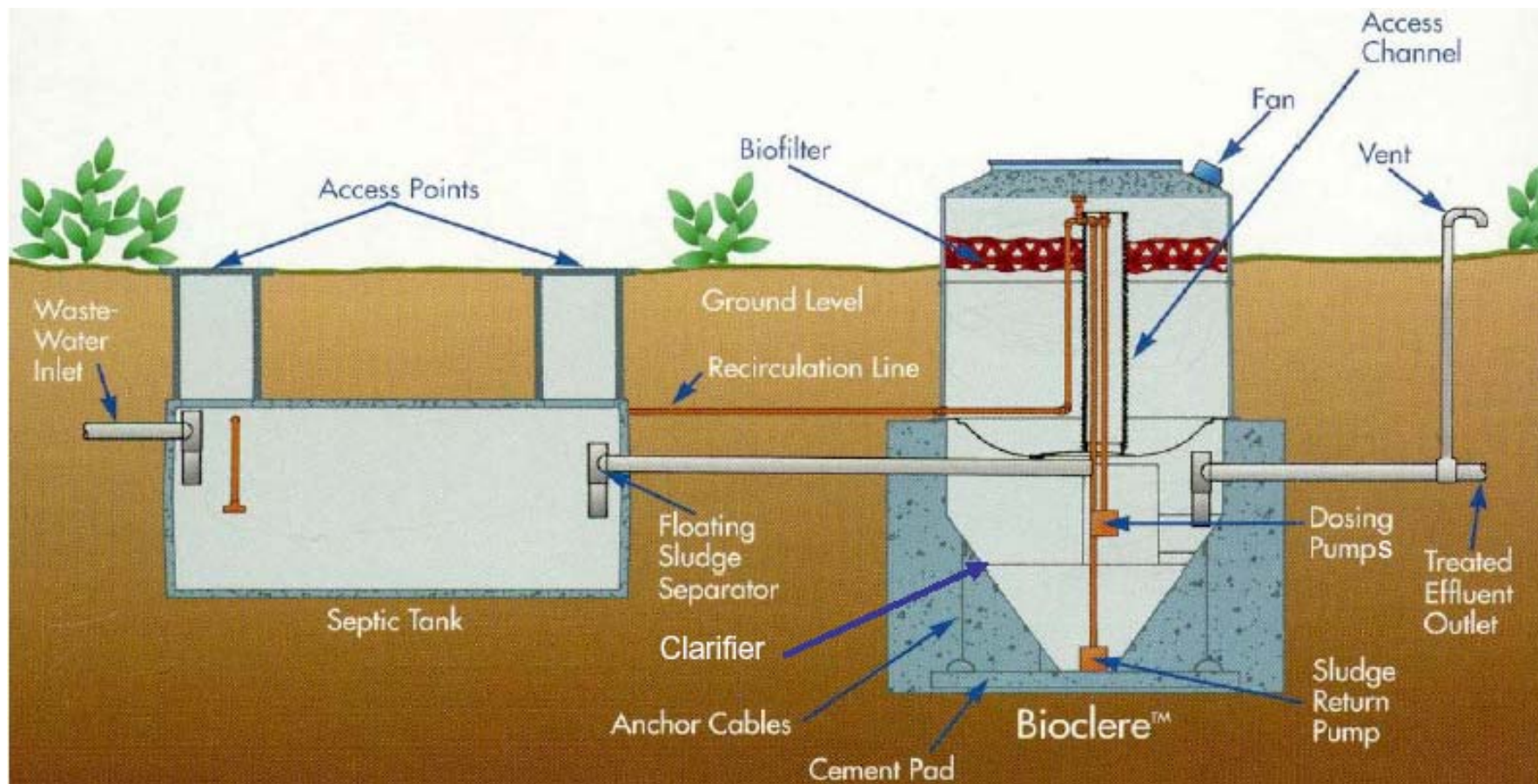
Recirculating Media Filters

- Most commonly available Recirculating Media Systems are:
 - SeptiTech System
 - Waterloo System
 - Advantex System
 - BioClere System
 - Recirculating Sand Filter (RSF)

Waterloo System



BioClere System





Dispersal / Reuse Systems

- Conventional Drainfield
- Drip Irrigation
- Reuse for Non-potable purposes
 - Irrigation
 - Toilet Flushing in Commercial Buildings
 - Cooling tower Make-Up, etc.



Nitrogen Removal

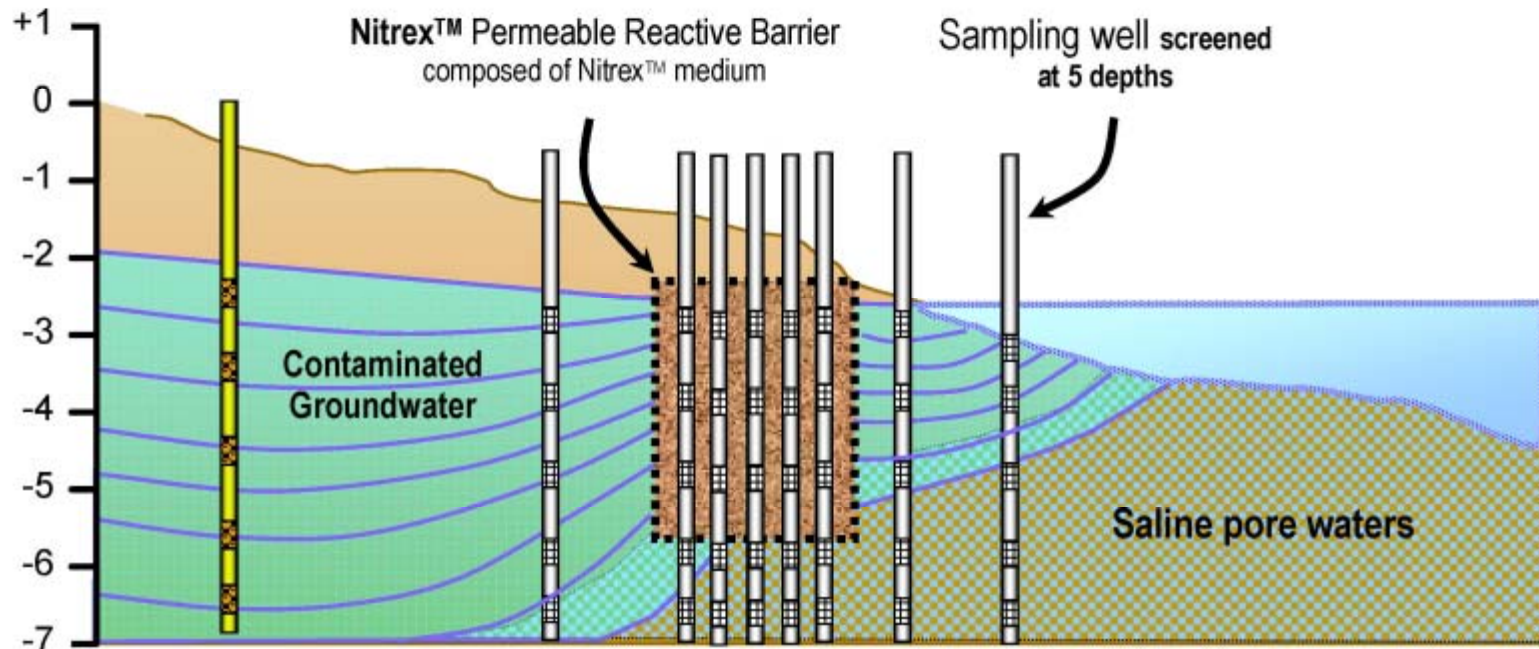
- Active or Passive Carbon feed or electron donor system
- Capable of achieving $TN < 5 \text{ mg/l}$



Phosphorus Removal

- Chemical (Fe or Al) Feed with sludge
- Geochemical Process – Mineralization
 - Reductive Iron Dissolution
- Capable of achieving TP < 0.5 – 1.0 mg/l

PRB for Groundwater Treatment



MADEP Title 5 (Flow < 10,000 gpd) Approved Wastewater Treatment Systems

Technology Category	Technology
SPF	Orenco Intermittent Sand Filter
	Puraflo
RMF	Omni Recirculating Sand Filter System
	SeptiTech Treatment Systems
	Bioclere
	Waterloo Biofilter
	AdvanTex Treatment Systems
IFAS	FAST
	Amphidrome
AS	Cromaglass WWT Systems
	JET Aerobic Wastewater Treatment
	OAR
	Norweco
MBR	MBR
Nitrogen Removal	Nitrex™
Phosphorus Removal	RID™

Treatment Process Applicability to Flows and Effluent Water Quality Requirements

Flow Range (gpd)	Effluent Water Quality				Treatment Technology				Nutrient Removal				
	BOD (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	Fixed Film	Activated Sludge	MBR	IFAS	Nitrogen		Phosphorus		
									Active Carbon Feed	Passive Carbon Feed	Active Metal Salt Addition	Passive Metal Salt Addition	
0 - 10,000 gpd <~250 residential units equivalent	< 30	< 30			x	x	Economically Infeasible	x	n/a				
	< 30	< 30	< 10		x	Not Reliable			x	x	n/a		
	< 30	< 30	< 10	< 1	x				x	x	x		
	< 10	< 10	< 5	< 1	x				x	x	x		
10,000 - 50,000 gpd ~250 - ~1,250 residential units equivalent	< 30	< 30			x	x	Economically Infeasible	x	n/a				
	< 30	< 30	< 10		x	x		Not Reliable		x	x	n/a	
	< 30	< 30	< 10	< 1	x	x				x	x		
	< 10	< 10	< 5	< 1	x	x				x	x		
50,000 - 100,000 gpd	< 30	< 30			Site specific analysis required to determine the most efficient and reliable system. Fixed film processes will tend to be more applicable to the lower end of flows in this range while Suspended Growth / Activated Sludge Systems will be favored at the hig				n/a				
	< 30	< 30	< 10						x	x	n/a		
	< 30	< 30	< 10	< 1					x	x	x	x	
	< 10	< 10	< 5	< 1					x	x	x	x	

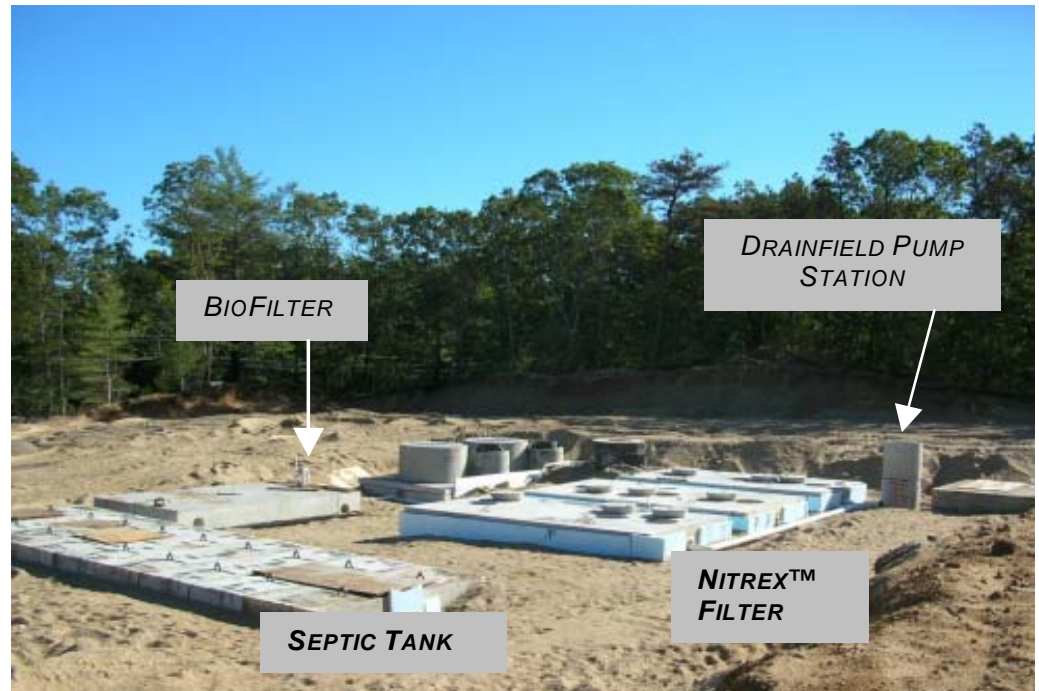


Case Studies

- Mashpee, MA – 5,620 gpd
 - 24 residential units
- Lake Wyola – Shutesbury, MA
 - Residential units
- Hamilton, MA – Central Business District

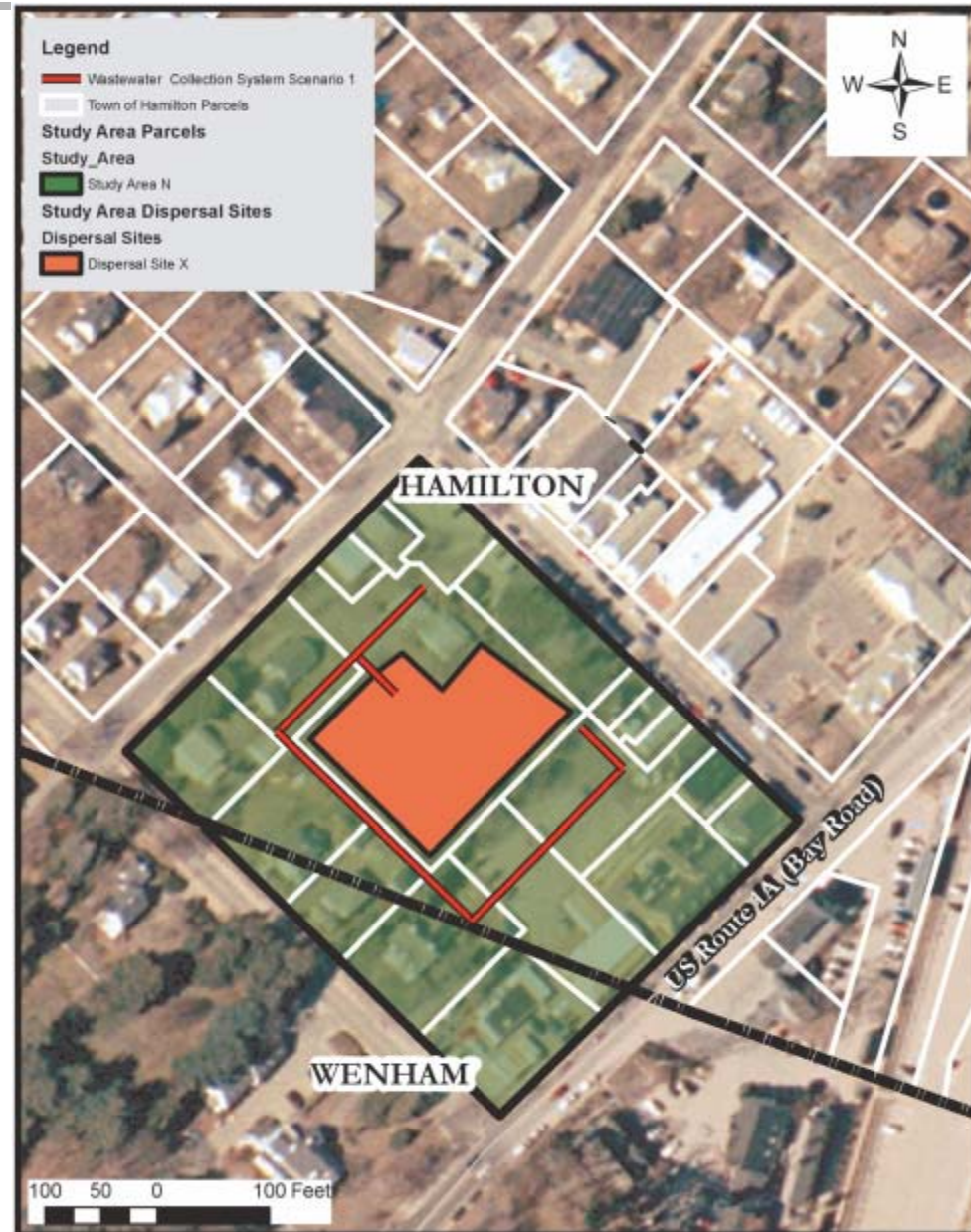
Mashpee, MA

- TN < 3 mg/l
- Monthly O & M visits
- Electricity Use - \$0.75 /day
- No chemical addition
- Normal Septage Removal

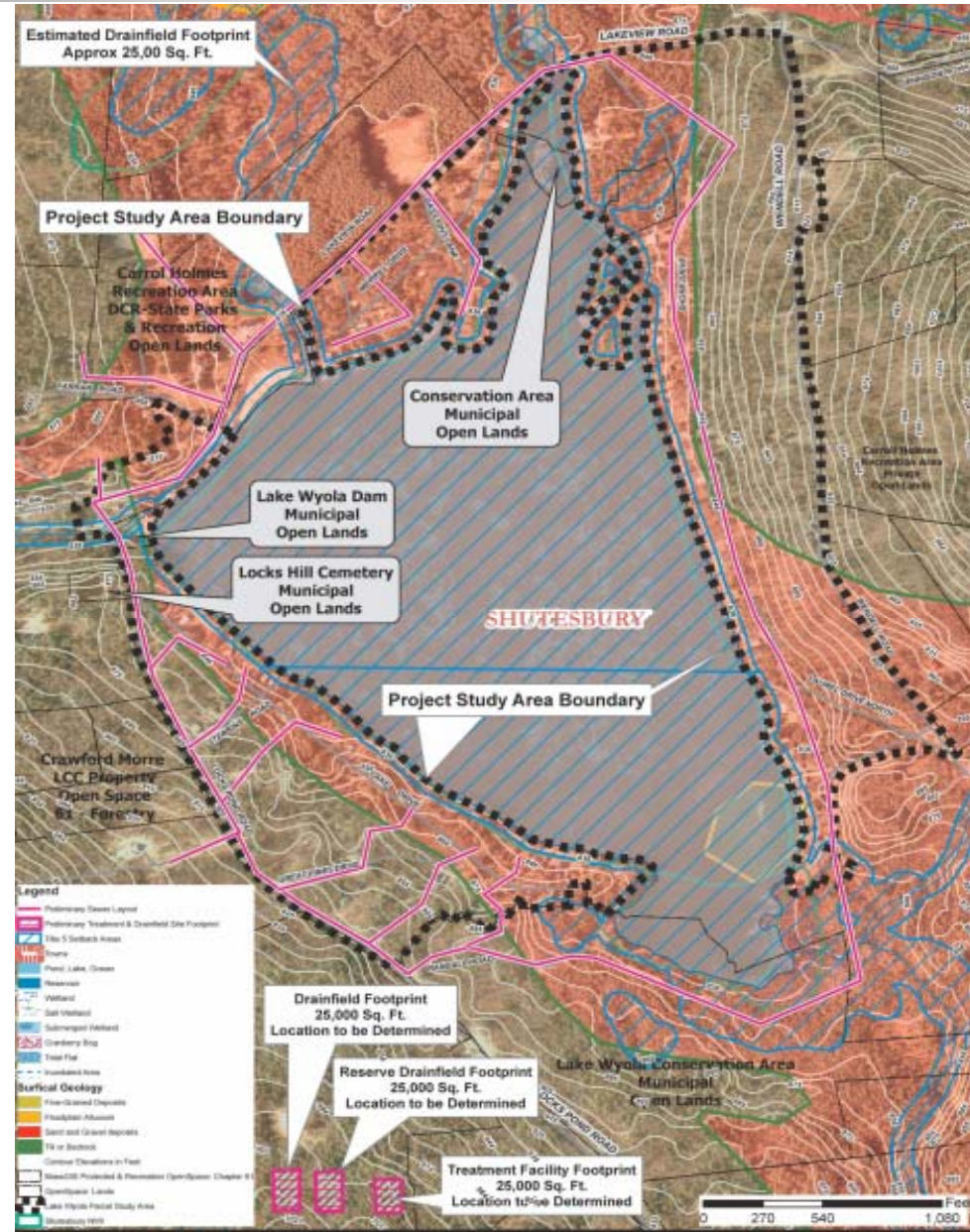


Hamilton, MA – Central Business District

- RMF Treatment System
- Gravity Collection System
- Groundwater Discharge
- 20,4000 gpd
- 26 users – 62 EDUs
- \$1,382,000 Estimated capital costs (\$22,4000 / EDU)
- \$81,800 Annual O&M Costs (\$1,330 / EDU)



- RMF Treatment System
- Step Collection System
- Groundwater Discharge
- 200 Users
- \$4,700,000 Estimated capital costs (\$24,000 / EDU)
- \$104,000 annual O&M Costs (\$520 / EDU)





Questions / Answers

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